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ABSTRACT

Findings of a longitudinal study of early intervention are presented in this report of two case studies of low socioeconomic status black children. A girl and boy, approximately three years old when first enrolled in the educational day care program, exhibited severe behavior problems. Intellectual, emotional, psycholinguistic and perceptual functioning were retarded. The focus of the preschool program was on the acquisition of skills leading to reading, typing and number concepts, with the relationship of intellectual development to affective and social development also considered. Special use was made of the "talking typewriter" and "talking page." Remarkable progress in overall development was shown by both children in preschool and continued throughout the period under study, to age nine. Test data is given for the 7 year period. Achievements in cognitive development of the two children indicate the same kind of exponential curve, growing slowly at first, then rapidly, in a basic pattern of escalation. The talking typewriter is seen as a tool whereby the learner can begin to develop attitudes about learning and substantial cognitive skills through which he can realize that he plays a significant role in controlling his environment. In each of these case histories, increasing confidence seemed to alleviate a particular problem: the girl's chaotic classroom behavior began to be self-directed into constructive activity; and the boy's inwardly-directed active imagination began to turn outward in a positive way. (Author/BF)

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DEVIATION-AMPLIFICATION:

TWO CASE STUDIES IN COGNITIVE DEVELOPMENT
A SEVEN YEAR REPORT
(1969-1976)*

International Association of Cybernetics
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DEVIATION-AMPLIFICATION: TWO CASE STUDIES IN COGNITIVE DEVELOPMENT, A SEVEN YEAR REPORT (1969-1976)

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Abstract

A longitudinal study of early intervention through technology in early childhood education presents findings of a follow-up study of two low socio-economic status (low SES) children. The children were approximately three years old when first enrolled in the program and exhibited severe behavior problems. Their I.Q.'s as measured by the Peabody were 72.7 and 70.7 respectively.

The focus of the training program was on the acquisition of skills leading to reading, typing and number concepts. Consideration is also given to the relation of intellectual development with affective and social development.

INTRODUCTION

Early intervention through the use of technology, specifically the "talking typewriter" and the "talking page"*, has been part of an educational day care program of the Early Childhood Center at Drexel University since 1967. It is the core of the training program and the mainsay of instruction for the acquisition of skills leading to reading, typing and number concepts. The children are aged 2.5 to 6 in a racially and socio-economically integrated program.

The training program is available on a voluntary basis to all children for up to 25 minutes a day as part of an educational day care program from 7:30 A.M. to 5:30 P.M., five days a week. Breakfast, two snacks, and lunch are available to all children, as well as other ancillary services. Research, to determine the areas, and extent of effectiveness of new approaches to learning, is an integral part of the Early Childhood Center. This Center currently stands alone in using the "talking typewriter" and the "talking page" with three, four and five year old children.

However, note that there is a distinction between training and education. Training involves the learning of some specific pattern of behavior, be it equilibrium on a tight rope or chess playing, etc., while education concerns the development of new, not previously learned behavior. Thus, in every field of human

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* Prentice-Hall subsidiary: Developmental Learning Centers, New Englewood Cliffs, New Jersey

endeavour, education would lead to accomplishment beyond the learned patterns. The result of education is creativity, while the result of training is performance involving skill and not necessarily creativity.

What brings into focus this difference, could be illustrated by the example of a trained "specialist" able to make a copy of a Vermeer which is hard to distinguish from the original. Whether it is in the field of painting or literature, or music, a master-work can be recognized by the individual master's style. A work by Rubens, Borodin, or Hemingway is traceable to the author by the average layman, provided he had some basic training to paint, compose music or write literary composition. While this kind of training is predicated on the assimilation of some previous experience, creative activity goes beyond previous experience. Education implies going beyond previous experience while assimilation of previous experience is the expected result of training.[1]

Education without knowledge or training is fruitless, just as training without education is sterile.

Two Case Studies, A Seven Year Report

Yearly studies since 1967, as well as longitudinal studies, have consistently supported positive findings in the use of this early intervention program. An analysis of deviation-amplification and its relation to cognitive development appeared in 1972.[2] The following is a continuation of this analysis as focused on two children whose progress we have been able to follow since 1969. These two children were the most difficult children that we had in our center in the last nine years.

THE FOLLOWING IS THE TEST DATA ON THESE CHILDREN

	SCHOOL NOW ATTENDING	SEX	RACE	ECONOMIC STATUS	GRADE	TEST DATE	R.E. TIME	MONTHS ENROLLED E.C.C.	C.A.	W.I.S.C.(R) VERB	W.I.S.C.(R) PERF	W.I.S.C.(R) FULL	P.P.V.T. (M.A.)	D.T.V.P. (P.A.) (FROSTIG)	I.T.P.A. AUD.	I.T.P.A. VIS.	I.T.P.A. COMB.	W.R.A.	W.R.R.	I.W.R. (DANIELS)	(SPACHE DCAG. IRI READ SCALE)	(IRI) BETTS	COMPRE. SCORE C.A.T. GRADE EQUIVALENT
					4	3/76			9-9	9-7	105	101	10-4	8-2	9-0			5.3	5.5	IN4		IN3	
					3	3/75	33h.	33	8-9				8-11	7-5	8-10	11-0+		4.2	4.5	IN4	IND	IN2	4.5
Child A.	Powel	F	B	G	2	3/74	11m.		7-8				8-2	6-3		10-6		2.8	3.8	IN3	5.5	ND	4.8
						6/72			6-0				6-2	5-3			6-4	ND	ND	ND		ND	
						10/71			5-4				5-11	3-6			5-8	ND	ND	ND			
						10/70			4-4				3-2				4-1						
						10/69			3-4				2-1				* *	*	*	*			
					4	3/76			9-4	88	78	82	8-9		8-1			4.2	5.7	IN4	IND5		
					3	2/75	39h.	27	8-2				7-10	9-0+	8-2	10-6		3.2	3.9	IN3	IN.3	IN3	3.3
Child T.	Hanna	M	B	G	2	2/74	47m.		7-2				7-0	9-0	7-8	9-0		3.2	2.9	IN1	IN.1	IN1	
	St.Agatha					4/72			5-5				3-11				3-0						
						10/71			3-11				2-2	3-8			3-3	*	*	*	*		
						10/70			2-11				* *	* *			* *						

KEY - C.A. - Chronological Age
Economic Status:
G-Get Set
T-Tuition
R.E. Time - Responsive Environment Time
E.C.C. - Early Child-Center
W.I.S.C.(R) - Wechsler Intelligence Scale for Children - (Revised)
VERB - Verval
PERF - Performance
FULL - Full Score

P.P.V.T.-Peaboy Picture Vocabulary Test (M.A.-Mental Age)
D.T.V.P.-Developmental Test of Visual Perception (P.A.-Perceptual Age)
I.T.P.A.-Illinois Test of Psycholinguistic Abilities - AUD -Auditory
VIS -Visual
COMB-Combined
W.R.A.-Wide Range Arithmetic
W.R.R.-Wide Range Reading
I.W.R.-Informal Word Recognition (Daniels Test)
I.R.I.-Informal Reading Inventory (Spache Diagnostic Reading Scale) (Betts Informal Reading Inventory) (IN-Instructional Level)

C.A.T.-California Achievemen Test (Reading Comprehension Score-Grade Equiv.)
IN-Instructional Level
IND-Independent Level
F - Frustration Level
PP-Pre-Primer Level
P.-Premer Level
k-Kindergarten Level
pk-Pre-Kindergarten Level
n-Nursery Level
*-Not Applicable
**-Untestable
n/d-Not Done

For child A. the psychological report reads as follows:

A. was admitted to the Center in September, 1969, when approximately three years old. At that time a battery of tests were administered to evaluate her intellectual, perceptual, and psycholinguistic functioning levels. Intellectually, she was performing as a borderline mental defective. Her perceptual skills were impossible to measure. Due to profound perceptual inadequacies, no score was obtainable on the Illinois Test of Psycholinguistic Abilities. Her emotional behavior was characterized by flatness of affect, extremely short attention span, perserveration, and symptoms of low self-esteem. Considerable prodding was necessary to obtain responses even to comparatively simple test items. Symptoms of malnutrition were also in evidence. During each year at the Center, she received the same evaluations noted above. After the first year, and each year thereafter, continual progress in intellectual, perceptual and psycholinguistic functioning was observed. Her emotional behavior improved markedly. At the time of the testing of 6/72 her mental age was slightly above her chronological age. Her ITPA score was half year above chronological expectation. Her word recognition skills were at the middle of the first grade level, while arithmetic achievement was approaching the second grade level. During the testing situation she was alert and quick, readily engaging the examiner in playful banter. She appeared extremely self-confident. She attempted every item despite difficulty of the material. The final testing revealed a youngster who appeared happy with herself, self-confident, and anxious to do well. Her academic skills were

well within the first grade spectrum although not yet in the first grade. Prognosis for this child is excellent.

Following is an excerpt from a teacher's annual report:

A. is presently a six year old Negro female well developed physically. She lives with her mother, father (who has recently completed a prison sentence) and 12 year old brother, son of her father by a previous marriage.

The focus of this report is the school year 1971-1972. During this time, teachers have been focusing on three areas of A.s development: her physical maturity which led her to prefer the company of older children, especially teenagers; her extreme caution in entering an endeavor in which failure is a possibility; and her seemingly purposeless behavior.

A. was an isolate within her group and turned to adults as the major source of support. A's kindergarten unit consisted of boys who formed a group exclusive of girls, two boys who played with both sexes, one boy who was an isolate, and three girls who formed a cluster and with whom A. had infrequent interaction. These girls did not exclude A. and seemed to regard her as a leader when she joined their activities. The one girl with whom A. interacted frequently was transferred to another class as their behavior was extremely disruptive and A. dominated the relationship to such an extent that the other child was unable to initiate and direct her activities. Additionally, there had been incidents of sexual precocity involving A. and a boy in the room.

Two things seemed to help A. during the school year. Her teachers made a consistent effort to have A. help them in the classroom. Whereas in the beginning she would often retreat to a chair and pout, with all efforts to talk with her achieving little, she later was able to discuss those things which disturbed her. Gradually she became more responsive to the affections of the teachers and was able to initiate activities and contact with others. This made it easier to have A. become involved in classroom activities, especially those which she previously might have regarded as threatening. Also, given A's proclivity towards older individuals, the teachers and college students provided A. with positive role models.

A second course of action which seems to have benefitted A. is her work with the typewriter. As the year progressed, and as A. went from letter recognition to some word recognition, she frequently requested turns at the typewriter. A high point of the year involved a story A. had written. It was a rather long story, yet every day A. requested to go to the non-automated typewriter to type it. At times, A. would tell the operator that she would not be able to finish the story. She was also reluctant to terminate the sessions, even after half an hour. With some encouragement and with the operator determining A's point of fatigue, A. finished the story after two weeks. In view of her past fear of failure and inattentiveness, this was indeed a significant accomplishment. Using the Dukane viewer, she began to develop a sight vocabulary, and to request to use the viewer daily. Finally, when in the classroom or on class

trips, whenever she saw a word she would ask the teacher what it was, often spelling the word and saying it after having it read to her. In summary, it appears that the experience with the typewriter has enabled her to acquire basic reading skills, persistence and enjoy learning.

A. has now had four years of additional schooling since the above case study report in "Deviation-Amplifying Process and Individual Human Growth and Behavior", [2] . Her last evaluation was completed in March of 1976, with a chronological age of 9-9, in grade four. The Illinois Test of Psycholinguistic Abilities and The Frostig Developmental Test of Visual Perception were not administered during this testing since she had obtained scores above the top of these tests in April of 1975. An additional test of intellectual functioning level (Wechsler Intelligence Scale for Children - Revised) was given for the 1976 testing. In addition, the Sapche Diagnostic Reading Scales was substituted for the Informal Reading Inventory for the 1976 and 1975 testing, due to its more exact standardization and its ease of administration. During the 1975 testing, both the Informal Reading Inventory and the Spache Diagnostic Scales were administered. The instructional levels from each scale proved to be the same.

During her last testing, she obtained a Peabody mental age of 10-4, closely approximating her chronological age. This performance was given additional substantiation by her attainment of a 101 Full Scale intelligence quotient on the Wechsler Scale.

"A" has continued to make steady, even progress in achievement. For example, her Wide Range Arithmetic Test grade scores went from 2.8 in 1974 to 4.2 in 1975 and to 5.3 in 1976. Thus, she is currently performing above grade expectation in arithmetic. Much the same story can be told when through a longitudinal focus on word recognition and reading comprehension: grade scores in word recognition (Wide Range) went from 3.8 in 1974 to 4.5 in 1975 to 5.5 in 1976; her instructional level in reading comprehension went from grade 2 in 1974 to grade 3 in 1975 and to grade 5 in 1976.

Thus, A. is at or above grade expectation in all the major indices of achievement. Prognosis continues to be excellent.

For child T., the psychological report reads as follows:

T. first came to the Center at the age of 2-11, in September of 1970. At that time he presented a lamentable picture. T. was quite thin, exhibiting many symptoms typically associated with undernourishment. He received the typical battery of tests to evaluate intellectual status, as well as to obtain indices of perceptual and psycholinguistic behavior. At that time he proved to be untestable. It was difficult to ascertain if he even understood what was expected of him. His speech was barely intelligible: he exhibited articulation difficulties as well as non-fluency patterns. His fine-motor coordination was quite poor. His gait was awkward. His social and mental maturity was estimated at the one year old level. Initially, his progress was slow indeed. Nevertheless, during his second year at the Center his social and emotional development, which appeared arrested during the entire

first year, began to show definite indications of accelerating. He was then able to establish peer group relations although he was still generally quite apprehensive and was extremely solicitous with peers in his attempts to maintain friendships. During this second year, his intellectual and achievement levels were still markedly retarded. During his third year his social-emotional development accelerated at a rapid rate. He began to exhibit self-confidence and much stabler peer relationships. His social maturity level now closely approximates chronological expectation. Intellectually, he is now functioning within the borderline range. His global score of the ITPA is at the third year level. Visual and auditory perception have improved substantially. He is now able to handle basic mathematical concepts while his word recognition score on the Wide Range scale is at the 1.1 level.

In summary, the belief here is that this youngster has made remarkable overall improvement. Had he not received an early intervention program, the six year old briefly described here would almost certainly be facing an uncertain school career, probably marked by severe social and emotional inadequacies. Instead, T's general prognosis can be characterized as fair to good, depending upon the quality of educational, social, and emotional opportunities.

Teacher's report from the year 1971-1972:

T. is a six year old Negro male. He was preceeded at the Center by his now seven year old brother. Presently his four year old brother attends the Center and plans are being made for

the attendance of his two year old sister. T. lives with his brothers, sister and mother. Intermittently, his father returns home. The father's latest absence had been due to a prison sentence.

When 3 year old T. first came to the Center, a staff member was assigned to him as he often ran to hide in small, dark places. When not hiding, he would watch the older children but seldom engaged in play. His major form of communication was tantrums.

Perhaps the most outstanding characteristic of T. is his visual acuity and imagination. In the beginning he was seeking dark secluded places. As time went on, however, this imagination and acuity began to present itself overtly. Once, when T. was gazing at a painting in a secluded living room, T. suddenly turned to the teacher and said he was afraid and wanted to leave. The painting contained dark colors and was of people in a narrow street circa 1870. At another time, T. was staring at the face of a college student. Upon completing his assessment, he told the student, "Your face looks like an egg." And indeed the symmetry of this student's oval features was accurately and artistically stated by T.

T's experiences on the typewriter ranged from sessions which had to be terminated because of disruptive behavior (raising the platicised cover of the keyboard's inner workings, which would have made the typewriter inoperative) to T's excitedly running out of the booth when he had made a new discovery. In the beginning, he would often request that the light in the typewriter booth be turned off while he typed. It was six months before T.

showed letter recognition; at this point, he recognized "T" the first letter in his name. As was to happen whenever T. made a discovery, he continually typed "T" for a number of sessions. Once he ran out of the booth and excitedly said "Gee! I'm smart!" In another instance, T. was typing numbers; when he typed "zero" he ran out of the booth shouting, "Zero, I typed zero, zero means nothing." Many sessions after this event consisted of T's typing "zero." The same persistent interest shown in the letter T and "zero" was applied by T. in learning his first word "owl." T. had shown great interest in a puzzle picture of an owl. A typewriter program about an owl was written. He repeatedly requested this story. Thus, on the typewriter, he continuously revealed an intense style of learning, completely exhausting one item before discovering another.

T. left the center in June of 1972. His verbal communication was quite fluent and contributed greatly to his sense of humor. By the time he left, T. took a healthy pleasure in teasing his teachers.

In regard to the two children studied, no one can project with certainty what might have happened to them without educational intervention nor what will happen to them with intervention. Yet one of the purposes of education is to enable growth, development and training to occur. The concept of responsive environments as applied in the technology of the talking typewriter is a new tool whereby the learner can begin to develop attitudes about learning and substantial cognitive

skills through which he can realize that he plays a significant role in controlling his environment. What is common to the children is their increase in confident behavior after establishing a core strength of intellectual ability and a positive attitude about the process through which they acquired that ability. What is peculiar to each is how this confidence seemed to alleviate their particular problem. With A., her chaotic behavior in the classroom began to be self-directed into constructive activity. The anxiety of many staff members that her sexual precocity would lead to early pregnancy began to diminish as she began to broaden her interest. The energies of T's active imagination which had been concentrated inward began to take delight in the outer world.

As with child A, Child T has now had four years of additional schooling since the above case study report [2]. In 1972 his Wide Range Word Recognition was at the 1.1 level, but few reading comprehension skills were in evidence. His intellectual development was the borderline mental defective range. His perceptual and psycholinguistic abilities were still below age expectation but had, nevertheless, improved substantially since the initial evaluation of 1970.

T. is now nine years of age, in the fourth grade. His Peabody mental age now closely approximates his chronological age while his Full Scale WISC-R intelligence quotient is well within the dull normal range. His verbal I.Q. of 88 approaches the normal range. In 1975 his scores on the Illinois Test of Psycholinguistic Abilities and the Frostig Developmental Test of Visual Perception had advanced to the upper end of both tests and

had little diagnostic value. These were again administered with much the same results - his performance remained at the top of both scales.

In the achievement area, T. continues to make very substantial progress. His present Wide Range Arithmetic grade score is 4.2 while his Wide Range Reading score has shot up to 5.7. His instructional level on the Spache scale, a test of reading comprehension, is currently 5.5.

When consideration is given to where he was - in terms of intellectual and perceptual development - in 1970, his present performance is nothing short of remarkable. Had T. followed the "expected" sequence of development, given his initial intellectual, perceptual, and psycholinguistic status, he should now be in a class for, at best, retarded educable with concomitant social and emotional debilitations.

In the light of what has been said here it may be instructive to hypothesize about what has occurred with the two children that have been reported on from a longitudinal perspective. The statement, "The more a child learns the more he uses his cognitive processes," has been used previously in another paper. [2] The literature is replete with studies which appear to indicate a continual decline, a deceleration in the acquisition of skills as well as functional, measured intelligence. Much of this deceleration in educational acquisition has been attributed to the retarding effects of certain environmental conditions. The crux of the

matter may well be the decided necessity, especially during the formative years of three to six, to provide for the child an opportunity to learn. For most children, this is evidently not a problem, since learning takes place with little apparent difficulty. But for a substantial minority, this learning does not take place as normative data would anticipate with a consequent decrease in self-esteem, and an increase in impulsive, sometimes destructive behavior toward themselves and others. The two case studies reported here exemplify what might occur if early intervention is successful, the anticipated deceleration is halted, the child begins to learn. Cases A. and T. were, even at the age of approximately three, on their way to becoming extremely inadequate learners. Their intellectual functioning was severely retarded, as evidenced by borderline intelligence quotients. Psycholinguistic abilities, as well as visual and perceptual skills, were decidedly under-developed. As they approached first grade with this impoverished learning repertoire, failure would be certain. Negative behavioral adaptation would surely emerge. They would, by the second or third grade, become candidates for special class, classes for the "educable retarded."

'Amplifying feedback adds a signal to preceding behavior which says, "Do more of it; increase the behavior." If the amplifying feedback signals add about the same proportion to the output in every cycle, the effect is comparable to compound interest...' [3]

The achievements in cognitive development of these two children indicate the same type of exponential curve. It grows slowly and then takes off. It is a basic pattern of escalation. If such a process continues with a constant rate of increments, it may run out of control. It is interesting to note the synergistic effect of emotional and social development that occurred. This is where controls operate so that behavior does not get out of hand, so that a balance is maintained. Energies are invested where there are inbalances. Thus, for example, starving concentration camp inmates' fantasies and dreams were totally about food.

The learning formats developed at the Early Childhood Center apparently were quite effective in reversing this too often repeated story of decline. Once effective learning occurred, these children began to rely increasingly on their cognitive processes, less and less on negative adaptation. A short delineation of their case histories should prove instructive.

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